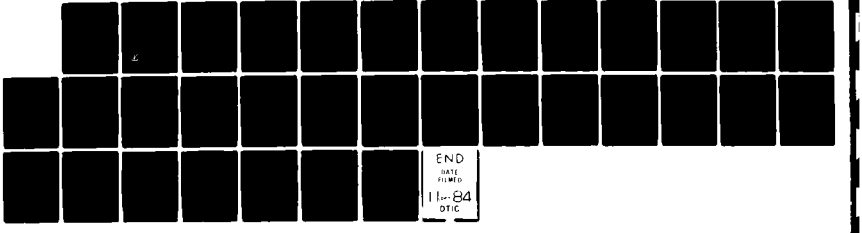
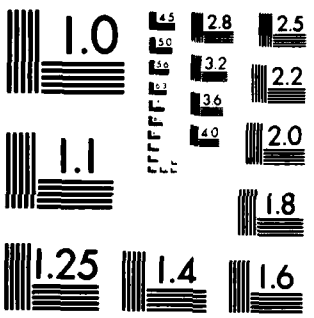
AD-A146 501 NAVAL SURFACE WEAPONS CENTER TECHNOLOGY TRANSFER REPORT 1/1
(FY83)(U) NAVAL SURFACE WEAPONS CENTER SILVER SPRING MD
R D JOHNSON 30 SEP 83 NSWC/MP-84-38

UNCLASSIFIED F/G 15/3 NL





NSWC MP 84–38

AD-A146 501

NAVAL SURFACE WEAPONS CENTER TECHNOLOGY TRANSFER REPORT (FY83)

BY RAMSEY D. JOHNSON

ADVANCED PLANNING STAFF

30 SEPTEMBER 1983

Approved for public release, distribution unlimited

NAVAL SURFACE WEAPONS CENTER

Dahlgren, Virginia 22448 • Silver Spring, Maryland 20910

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NSWC MP 84-38	2. GOVT ACCESSION NO. AD-A146 501	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) NAVAL SURFACE WEAPONS CENTER TECHNOLOGY TRANSFER REPORT (FY83)		5. TYPE OF REPORT & PERIOD COVERED ANNUAL; FY83
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Ramsey D. Johnson		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Surface Weapons Center (Code D21) White Oak Silver Spring, MD 20901		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS N/A
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE 30 September 1983
		13. NUMBER OF PAGES 35
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Technology Transfer
Navy

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report describes the Naval Surface Weapons Center Technology Transfer Program and presents narrative summaries of related projects performed during FY83. Technology Application Assessment forms and a listing of patents/Navy cases for this time period are also presented.

top. ↓

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-LF-014-6601

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

FOREWORD

The Naval Surface Weapons Center (NSWC) Technology Transfer Report (FY83) has been prepared in accordance with the format and content currently specified by the Chief of Naval Material for Navy inputs in meeting the reporting requirements of the Stevenson-Wydler Technology Innovation Act of 1980 (Public Law 96-480).

The objectives of Navy technology transfer are (1) to disseminate information on non-critical technology, originally developed in support of military applications, for potentially alternative uses in the public and private sectors; and (2) to promote joint cooperative development programs that address problems of mutual concern to the Navy and other agencies or organizations. In pursuit of these objectives, the Navy transfers technical expertise to other Federal Government agencies; state and local governments; small and large businesses; nonprofit organizations; and such public service organizations as schools, hospitals, and foundations. In addition, technologies that have direct impact on the Navy mission and programs are transferred within, or into, the Navy. Transfers of hardware, software, management practices, and expertise are made in diverse fields, such as analysis and testing, communications, energy, environment, transportation, and marine technology. The Navy Technology Transfer Program provides unique services not available from the private sector and not in competition with that sector. The underlying philosophy and approach is to promote domestic technology transfer activities of non-militarily critical technical material that is approved for public release.

A substantial portion of the information in the Appendices of this report was contributed by NSWC technical staff members engaged in Center technology transfer tasks. Questions or requests for additional information should be referred to NSWC, Code D21, Mr. Ramsey D. Johnson, (301)394-1505 or Autovon 290-1505.

Approved by:

D. N. Dick

D. N. DICK
Advanced Planning Staff

A-1

CONTENTS

1. ORGANIZATIONAL STRUCTURE FOR TECHNOLOGY TRANSFER

a. The technology transfer policy of the Naval Surface Weapons Center (NSWC) is administered by the Advanced Planning Staff (Code D21). The staff provides advanced planning information on matters impacting the role, mission, and long-term commitments of the Center. Policy implementation vehicles for technology transfer include the Center's Office of Research and Technology Applications (ORTA), the Navy/Industry Cooperative Research and Development (NICRAD) Program, and the Federal Laboratory Consortium for Technology Transfer. Technology transfer functions include:

(1) coordinating the program within the Center

(2) maintaining external liaison (with the Chief of Naval Material, the Federal Laboratory Consortium for Technology Transfer, the Department of Commerce, other Federal agencies, state and local governments, universities, and private industry)

(3) preparing Technology Application Assessments

(4) assisting potential user organizations in formulating their problems

(5) providing and disseminating information on federally owned or originated products, processes, and services having potential application to state and local governments and private industry.

(6) providing technical assistance in response to requests from state and local governments.

b. The Center's Engineering Department, Technical Publications Division, provides direct support to the Chief of Naval Material (NAVMAT-08I) in publishing the monthly "Navy Technology Transfer Fact Sheet" which is widely distributed in industry, government, and the military.

c. Funding support of technology transfer activities in FY83 as a function of Center Departments is presented below:

	FY83 ($K)
(1) Administrative Functions	
Advanced Planning Staff	35
Technical Publications Division	105
(2) Technical Functions	
Engineering Department	6
Electronics Systems Department	174
Weapons Systems Department	425
Strategic Systems Department	179
Research and Technology Department	182
Underwater Systems Department	508
Total	1614

d. The following technology transfer policy instructions are in effect at NSWC:

(1) NAVSWCINST 3900.1A of 22 December 1981; Subj: Navy/Industry Cooperative Research and Development (NICRAD) Program. The purpose of this instruction is to establish procedures for processing NICRAD agreements in accordance with NAVMATINST 3900.14.

(2) NAVSWCINST 5700.2 of 23 July 1982; Subj: Office of Research and Technology Applications (ORTA). The purpose of this instruction is to establish the Center ORTA.

e. The Center point-of-contact for ORTA and the NICRAD program is Mr. Ramsey D. Johnson, Code D21, (301)394-1505 or Autovon 290-1505.

2. ACCOMPLISHMENTS AND CURRENT EFFORTS SUMMARY

a. Narrative summaries of NSWC technology transfer related projects involving FY83 effort are presented in Appendix A.

b. Completed technology assessment forms for the following items are presented in Appendix B:

(1) Electronic Thermostat

(2) Magnetomechanical Transducer

(3) MHD Analogy Instrument

(4) Hydraulic Analogy Test Instrument

(5) Radiographic Nondestructive Evaluation

c. NSWC MP 82-468, Naval Surface Weapons Center Technology Transfer Biennial Report (FY81/82), was published for public release in FY83.

3. INFORMATION DISSEMINATION AND WORKING RELATIONSHIPS

a. NSWC is a member of the Federal Laboratory Consortium for Technology Transfer, and participates in meetings, symposia, and exhibits related to technology transfer activities involving the Navy, state and local governments, and private industry.

b. NSWC publishes the "Navy Technology Transfer Fact Sheet." FY83 inputs to this document are listed below:

(1) Program Makes Major Advance in Li/SO_2 Reserve Battery Development

(2) NSWC Assumes Lead Role in Lithium Battery Safety

(3) International Group Compiles Earth's Polar Motion Values

(4) Environmentalist Aids County in Building Retrofit

(5) Eddy Current Technology Extends to Graphite Epoxies

(6) Magnetohydrodynamic Analogy Instrument Tests Supersonic Flows

(7) Battery Grid for Submarines May Have Industrial Uses

c. NSWC participated in the following significant Technology Transfer functions:

(1) Conference: Government-Industry Technology Transfer Conference
Sponsor: Federal Laboratory Consortium for Technology Transfer
Date: 8, 9 February 1983
Place: Baltimore, MD
Comment: The purpose was to provide industry with information about Government-developed technology and engineering innovations that have the potential for commercialization. Participants included representatives of 10 government activities and 23 private companies.

(2) Manufacturing Technology Review: Titanium Manufacture and Fabrication
Sponsor: Naval Sea Systems Command
Date: 13 January 1983
Place: Niles, OH

(3) End-of-Project Technology Transfer Demonstration: Electronic Level Sensor and Indicating System
Sponsor: Naval Sea Systems Command
Date: 13 April 1983
Place: Kansas City, MO

(4) End-of-Project Technology Transfer Demonstration:
Graphite Aluminum Tape and Tooling
Sponsor: Naval Sea Systems Command
Dates: 8 March and 25 April 1983
Places: Chatsworth, CA and Columbus, OH

d. NSWC made the following NICRAD Program Policy Agreements in FY83:

COMPANY	PROJECT TITLE	EFFECTIVE DATES
(1) Sanders Associates, Inc.	Advanced Ascent Mine Acoustic Studies	2/83 to 12/85
(2) MariPro/Science Applications, Inc.	Passive Detection Studies	2/83 to 11/85
(3) Aerojet Ordnance Co.	Study of Penetrator Materials and Configurations to Defeat Close-in Threat	3/83 to 2/86
(4) Gould Defense Systems, Inc.	Charged Particle Beam Weaponization Study	3/83 to 3/86
(5) Brimrose Corporation of America	Manufacture of Far Infrared Multicolor Epitaxial Pb Alloy Detectors	4/83 to 3/86
(6) FMC Corporation	Carrier Battle Group Simulation Modeling	4/83 to 3/86
(7) General Research Corp.	Passive Acoustic Detection Systems Study	5/83 to 5/85
(8) AAI Corporation	Microwave Expendable Decoy	6/83 to 2/86
(9) Martin Marietta Corp.	Sea Control Missile Requirements and Technology Study	6/83 to 5/86

e. NSWC Inventions and patent disclosures in FY83 are listed in Appendix C.

f. In support of state and local governments, NSWC responded to requests for technical information from the following organizations:

(1) Oregon State Police (night and foul weather observation devices)

(2) California Department of Corrections/American Justice Institute (contraband detection and interdiction)

(3) Elk City, Oklahoma (NITINOL information for potential local business ventures)

APPENDIX A

NARRATIVE SUMMARIES FOR NSWC FY83 TECHNOLOGY TRANSFER RELATED PROJECTS

1. MANUFACTURING TECHNOLOGY

The Navy Manufacturing Technology Program requires that technology transfer to the private sector and government agencies be a major activity of each funded project. Accordingly, upon completion each project is required to have an end-of-project demonstration for potential users or vendors, and to issue a final report. In both instances, efforts are made to disseminate the information to the widest possible audience. In addition, each project manager is encouraged to actively communicate with interested parties during the project to transfer the developing technology. NSWC also provides technical and administrative support to the Naval Sea Systems Command (NAVSEA) for manufacturing technology programs in the areas of weapons, explosives, and propellants. In FY83, NSWC and NAVSEA participated in the following projects:

a. Review of Titanium Manufacture and Fabrication

b. End-of-Project Demonstration for Graphite Aluminum Tape and Tooling

c. End-of-Project Demonstration for Electronic Level Sensor and Indicating System

2. U.S. COAST GUARD DIVING EQUIPMENT PROGRAM

The objective of this FY82 and FY83 project was to bring U.S. Coast Guard diving equipment and procedures into conformance with Navy standards. The program consisted of a survey of Coast Guard diving equipment, selection and procurement of approved equipment, and technical support in the operation of the Coast Guard diving program. Emphasis was on the selection and procurement of surface supplied and SCUBA equipment. An air supply system was designed and procured, and an MK 12 diving system was procured for the Coast Guard Strike Force Dive Team. In FY83, NSWC provided technical support and consultation in the areas of design, development, and selection of diving equipment and procedures. Additionally, a variety of equipment was procured and delivered to Coast Guard units.

3. SPACE SHUTTLE BOOSTER WATER ENTRY

NSWC has supported NASA (Marshall Space Flight Center) for several years during Space Shuttle System development. During FY83, the support was directed toward solving problems encountered during the recovery phase of the Solid Rocket Boosters (SRBs). The standard post-launch operational deployment requires the spent boosters to be parachuted nozzle-first into the ocean, followed by recovery for subsequent refurbishment and reuse. However, unexpected structural damage was being sustained during water entry, and this resulted in unexpected, additional redeployment costs. NSWC's contributions to the completed effort, which significantly reduced the water impact damage, were as follows:

a. Participated in a Navy Advisory Group to provide expertise and consultation to NASA.

b. Conducted 47 cavity entry tests in the Hydroballistics Facility under vacuum scaling conditions to measure cavity collapse loads.

c. Conducted 73 water entry launches of highly instrumented, full-scale sections of the SRB skirt to measure water impact loads.

4. HYDROBALLISTIC FACILITY

NSWC provides a hydrodynamic testing facility for use by Federal agencies and private industry. The parallelopiped test tank has inside dimensions of 100 feet in length, 35 feet in width, and 75 feet in height. Water depths up to 65 feet are possible while the normal depth is 60 feet. A major feature of the tank is the ability to create a vacuum above the water surface which provides the proper conditions for correct scaling of model tests. Photographs may be taken through the 152 viewing ports located on three sides of the tank and its top and bottom, or by existing underwater systems. During FY83, test services were supplied to NASA to support the Space Shuttle Program, and to a number of contractors who tested several systems.

5. GPS GEODETIC RECEIVER SYSTEM

a. Using the signals from the Global Positioning System (NAVSTAR) Satellites, the GPS Geodetic Receiver System will provide remote realtime point positioning approaching 1 meter accuracy in 4 to 6 hours versus 24 to 36 hours using the Navy Navigation Satellite System (TRANSIT). Relative position determination between 2 sites, 100 to 250 kilometers apart, will approach 2 centimeters in accuracy after approximately 4 hours on site, and 4 meter positioning accuracy will be typical when the Receiver System is used on a low dynamic survey vessel or aircraft. These are requirements that the sponsors, Department of Interior (U.S. Geological Survey); Department of Commerce (NOAA-National Geodetic Survey); and Defense Mapping Agency, have placed on the Receiver System. An attractive feature of the Receiver System is its software controllability offering relatively easy adaptation for either special geodetic or nongeodetic applications.

b. NSWC was selected to direct the Receiver System development due to its previous geodetic work with TRANSIT, and continuing work with GPS. In addition, NSWC has developed the first set of fixed position solution software and is integrating it in the hardware. The integration is to be completed in early FY84. Additional software operational enhancements are being developed for later integration into the Receiver System. Texas Instruments, Inc., developer of the hardware, will deliver three prototypes in early FY84. The remaining seven preproduction Receiver Systems and six sets of spares are to be shipped during the following two months. A four-month Receiver System lab and field test program is scheduled to start in FY84.

6. HNS PHOTODECOMPOSITION STUDY

The objective of this work, funded by NASA (Johnson Space Center), was to further characterize HNS explosive and its impurities by determining its sensitivity to undergo photodecomposition, and to identify the resultant effects on detonating cord performance. The technical approach involved collecting kinetic data on the rates of photolysis of HNS and HNBiB (the major inpurity in the HNS synthesis). NSWC involvement was to:

a. establish the kinetics of photodecomposition of HNS and HNBiB when carried out in sunlight and in mercury lamp irradiation using borosilicate glassware.

b. isolate and identify major photoproducts produced from this reaction using techniques such as thin layer chromatography, high performance liquid chromatography, gas chromatography, mass spectrometry, and nuclear magnetic resonance.

c. expose specially prepared detonating cords to selected temperatures for performance comparison with non-irradiated HNS cords.

7. FAA ADVANCED AUTOMATION PROGRAM

The Department of Transportation/Federal Aviation Administration (FAA) is in the process of modernizing its computer systems that track and control air traffic in the continental United States. One phase of this program was to develop and initiate the implementation of a plan to assure that the computer systems have sufficient capacity to perform over the life of the system. The plan can be readily adapted to most realtime embedded computer systems. Based on NSWC's experience in the area of capacity management, the FAA funded the Center to provide technical consultation for the plan. This assistance commenced in late FY82 and was completed in late FY83.

8. NUCLEAR POWER PLANT SEISMIC EVALUATION

a. In FY81, FY82, and FY83, NSWC provided structural expertise to the Nuclear Regulatory Commission (NRC), in the review of the Final Safety Analysis Report (FSAR) in conjunction with operating license applications at the

following nuclear power plant sites: (1) Midland, Michigan; (2) Waterford, Louisiana; and (3) Commanche Peak, Texas. At the FSAR stage, the applicant describes with specific engineering data the design conclusions and details of Category I Structures, Systems, and Components. Demonstration of compliance to applicable NRC regulations and requirements in all aspects of design, analysis, fabrication, and erection of Category I Structures and Systems is a prerequisite for approval of the FSAR. Upon completion of the FSAR review, evaluation, and approval, the applicant receives an operating license for commercial plant operation. In addition to the FSAR reviews, NSWC also participated in safety reviews for the following types of plant designs: (1) a standard nuclear steam supply system plant design submitted by a vendor; and (2) a standard Balance of Plant design submitted by a utility applicant/architect-engineering firm.

b. Specific NSWC support to NRC has included:

(1) Reviewing and evaluating the FSAR in accordance with the NRC accepted criteria

(2) Preparing preliminary safety evaluation reports

(3) Consulting with applicants and NRC staff to discuss and resolve open issues and assess additional information submitted by the applicant

(4) Auditing structural designs

(5) Preparing affidavits and testamonies involving Category I structures

c. NSWC issued and completed a contract to Butler Analysis, Inc., to prepare a preprocessor program to convert an acceleration time history on a rigid base to a forcing time history distributed over a cylinder modeled first as a shell, then as a stick model. A set of user instructions was delivered, and an executable program was tested on an NSWC computer.

d. NSWC issued a contract to extend the use of NASTRAN in performing seismic analysis by the direct transient, modal transient, and direct frequency response methods. Within the constraints for dynamic modeling, the code will be capable of accepting the finite element specifications provided by the user and yield displacement, accelerations, and element forces at specified points and time. Element stresses at the centroid of specified elements as a function of time can also be obtained. Deformed plots of structural response as well as X-Y plots of the stresses at specified points and time will also be provided. The final report will include a technical description of the code, the basic theory, and a users manual section.

9. HIGH ALTITUDE PARACHUTE DEPLOYMENT

NSWC provided technical expertise and engineering design coordination to NASA (Goddard Space Flight Center) for a high altitude parachute deployment (90km region) and recovery program. Center participation included support in the following areas:

a. Modifications to parachute systems (redesign of panel attach points, installation of radial load lines, redesign of parachute riser to incorporate attach point for load lines, and design and installation of crown area load lines)

b. Systems drawings and packing procedures and techniques

c. Flight test participation (with post-test analysis of unsuccessful recovery attempt, and recommended fixes)

10. UNIVERSITY RESEARCH ASSIST

NSWC participates in a continuing cooperative effort with the Catholic University of America by providing Van de Graff accelerator and computer assistance for the development of an improved data base and predictive capabilities in heavy ion stopping powers and ion-induced K-shell ionization probabilities. The effort has applications in materials modification through ion implantation and surface layer alloying, and ion materials analysis through ion-induced X-ray production.

11. FACILITY HOST/TENANT SUPPORT

NSWC supported the National Oceanographic and Atmospheric Administration (NOAA) and the University of Miami in host/tenant agreements at the NSWC Ft. Lauderdale Test Facility. The support included providing pier space, building space, utility services, and manpower assistance. NOAA installed a computer controlled data acquisition system in an oceanside structure at the Ft. Lauderdale Facility. NSWC personnel emplaced a transducer on an underwater cable so that NOAA/university researchers can monitor gulf stream current effects on acoustic signals.

12. COLLEGE COMPUTER SCIENCE PROGRAM

In May 1981, an NSWC technical staff member was detailed as a full-time faculty member to Mary Washington College (MWC) in Fredericksburg, Virginia, for one year. He has significantly contributed to the computer science program at MWC in teaching and curriculum development. At the request of MWC, his assignment was extended for the academic year ending May 1983.

13. TOURMALINE GAGES

a. The original tourmaline gage was designed and developed under Navy contract at Woods Hole Oceanographic Institute during WW II . These gages are used in the measurement of shock wave phenomena from underwater explosions. After the war, scientists formed Crystal Research Company to market the gage; the company closed in 1972. NSWC purchased the company assets and began producing gages to fill the void left by the defunct company. Improvements have been made to the gages in relation to evolving technology.

b. NSWC constructs and calibrates the gages which are sold at fixed price to various government and industry research activities. Gages and related information are exchanged with foreign governments with whom the U.S. has information exchange agreements. Gage purchasers included the Department of Interior (Bureau of Mines); Elda Trading Corp.; Battelle; IREECO Chemicals; and Gulf Oil Chemicals.

14. HYDROGEN GAS GENERATOR

Based on previous NSWC experience in the development of hydrogen gas generators as power supplies for actuators and fluidic sequencers, the Department of Interior, Geological Survey funded NSWC to develop such a power supply for an underwater cavitation erosion gun which could be used for cleaning off-shore structures used for oil exploration. A prototype generator was developed in FY82. FY83 effort was limited to test preparations and material procurement due to funding limitations. It is projected that funding will be available in FY84 to support device testing.

15. POSITRON LIFETIME STUDY

This is a research study funded by NASA (Langley Research Center) directed towards nondestructive evaluation of composite materials; it involves the extension of the technique from the study of fatigue in metals to the study of moisture in polymer resins. Positrons emitted from a suitable radioactive source enter a specimen of resin matrix composite or other polymeric material, and they interact with negative electrons in the host material to produce annihilation gamma rays. The time between positron injection and emission of the gamma rays (on the order of a few nanoseconds) has been shown to be dependent on the amount of absorbed moisture in the specimen. This technique is being studied for potential use in monitoring environmentally absorbed moisture (in resin-matrix composites) that can affect mechanical properties. NSWC provided computer data analysis support in FY81, FY82, and FY83.

16. EXPLOSIVE TRANSFER LINES EVALUATION

NSWC participated in a service life evaluation program conducted on rigid explosive transfer lines used to initiate aircraft emergency crew escape functions for a wide variety of military and NASA aircraft. The purpose of the program, sponsored by NASA (Langley Research Center), was to determine quantitatively the effects of service, age, and degradation on rigid explosive transfer lines to allow responsible and conservative service life determinations. Service life extension provides the opportunity for considerable cost savings of aircraft crew escape systems. NSWC developed and performed the chemical analyses and photographic tests for the program.

17. PROMPT GAMMA TESTING OF ELECTRONICS

NSWC provides prompt gamma irradiation testing services to Federal agencies and private industry, as well as providing consultation on electronics hardening against nuclear radiation. New high-density, integrated electronics are particularly susceptible to ionizing radiation from nuclear sources. Prompt gamma is very effective in upsetting digital electronics such as microprocessors and computers. Designers use a variety of approaches to harden against these effects. Testing circuits, components, and materials in representative environments is an integral part of the design process. In FY82, FY82, and FY83, NSWC provided such testing support to several organizations (government and industry).

18. IMPACT SENSITIVITY TESTS

NSWC provides explosive facilities testing support to other government agencies and industry. In FY83 the Department of Energy (Lawrence Livermore National Labs) funded NSWC to conduct impact tests to determine the sensitivity of various explosives.

19. RADIOGRAPHIC INSPECTION OF FUEL CELL INSULATORS

The Brunswick Corporation funded NSWC in FY81, FY82, and FY83 to perform radiographic inspection in the nozzle/fuel cell bonding area of the space shuttle propulsion system. A double-film, two-level exposure technique is used to assess the bond at specified intervals around the periphery of the assemblies.

20. UNDERSEA WEAPONS TANK

NSWC provides an underwater testing facility for the use of Federal agencies and industry. The Undersea Weapons Tank is 50 feet in diameter and 100 feet deep. A major feature is the retrieving platform or false bottom, operating to the 100 foot depth and providing quick recovery of the test units. There are six viewing platforms around the outside of the tank. During FY83, test services were supplied to NOAA to support polluted water diving tests, and to a number of contractors who utilized the facility in testing various systems.

21. HYDROACOUSTIC FACILITY SERVICES

NSWC's Brighton Dam Hydroacoustic Facility provides technical support and services to other government activities and private concerns for underwater equipment testing and analysis. In FY83, NSWC supported NOAA in conducting acoustic measurements and directivity patterns on an instrument used to determine underwater current profiles. NSWC also conducted underwater acoustic measurements on equipment for Applied Hydroacoustic Research, Inc.

22. DOT CONTAINER TESTS

At the request of the Department of Transportation, NSWC performed test and evaluation of specified hazardous shipping containers to determine their suitability in meeting DOT specifications for special shipping containers. The work (performed in FY81, FY82, and FY83) consisted of drop tests, repeated impact tests, dimensional checks, and pressure and strength tests. Test results have been reported to DOT.

23. MAGNETIC MEASUREMENTS

NSWC operates a Magnetic Structures Test Facility which is available to support specialized requirements of other government activities and private industry. In FY83, a Honeywell-funded project involved eddy current measurements on aluminum plates using a cesium vapor magnetometer and a spectrum analyzer. The data were required by Honeywell for empirical verification of an analytical method to compute eddy currents.

24. PHOTOGRAPHIC SERVICES

Under a support agreement with the National Bureau of Standards, NSWC performed diagnostic and repair services on a high-speed camera. NSWC also provided use of a movie film processor on an interim basis.

APPENDIX B

NSWC FY83 TECHNOLOGY APPLICATION ASSESSMENT FORMS

TECHNOLOGY APPLICATION ASSESSMENT

Date: 9/30/83
CUFT #:
LAB #: NSWC-TAA-83-001

1. Laboratory Naval Surface Weapons Center

2. Contact (ORTA) Ramsey D. Johnson
Phone 394-1505 (301) Autovon 290-1505

3. Address Silver Spring, MD 20910 (Code D21)

4. Technology Name Electronic Thermostat

5. Technology Type: (a) Process (b) apparatus (c) material (d) service (e) study (f) other:

Descriptors: Thermostat; Electronic

Applications: Thermostatic switching

6. Users (a) Federal Government (b) State Government (c) Local Government (d) Small ind. (e) Medium ind. (f) Large ind. (g) Consultant (h) other:

7. Potential Support: (exclusive license,) consulting, joint venture, drawings, tooling, computer prog., economic study, training, adaptive eng., other:

8. What Problem Does It Solve and How? Mechanical thermostats (using temperature sensitive metal alloys) are subject to contact deterioration and malfunction and are also susceptible to shock and vibration environments. The electronic thermostat contains no moving parts and is not subject to these disadvantages. The device uses the voltage/temperature relationship of a silicon semiconductor together with an OP-AMP comparator and logic gate. It provides a digital control signal for control of equipment using standard digital logic levels.

9. Other Uses: Unidentified

10. Main Advantages: Reliability

11. Production Information: Can be assembled with off-the-shelf, low-cost components using normal laboratory equipment and facilities.

12. Descriptive Literature: U.S. Patent #4,137,770

13. Literature Available From: Patent Office and NSWC ORTA

Date: 9/30/83
Lab #: NSWC-TAA-83-001

TECHNOLOGY APPLICATION ASSESSMENT

14. Description

Electronic Thermostat

A design for an electronic thermostat, capable of generating a digital control signal, has been patented (U.S. Patent #4,137,770) at NSWC. Made specifically for use in situations where the power supply is limited, this thermostat is unique from other commercial electronic sensing devices currently available for use in normal power supply situations. It is particularly useful in applications where high reliability under adverse conditions, such as shock or vibration, is required.

Thermostats used to control the operation of machinery and equipment have generally been designed around a mechanical means for temperature sensing. One example would be strips of metal alloys configured to trigger a switch as they expand and contract in response to changes in temperature. With repeated use encountered during industrial applications, the contacts of such switches tend to deteriorate and malfunction.

The electronic thermostat designed at NSWC does not contain mechanical parts and is not subject to these disadvantages. A silicon junction diode is used as one element of a resistance bridge to form the thermostat's temperature sensing element.

Furthermore, because controls for most machinery and equipment now use standard digital logic levels, the NSWC thermostat is designed to provide a digital control signal. Used in conjunction with a voltage comparator circuit having positive feedback, the control signal is provided whenever the temperature of the sensing element rises above a preselected value.

The patent on the electronic thermostat developed at NSWC is available for either exclusive or nonexclusive licensing. The concept has been incorporated into a U.S. Navy weapon component now in production.

TECHNOLOGY APPLICATION ASSESSMENT

Date: 9/30/83
CUFT #:
LAB #: ~~NSWC-TAA-83-002~~

1. **Laboratory** Naval Surface Weapons Center

2. **Contact (ORTA)** Ramsey D. Johnson
Phone 394-1505 (301) **Autovon** 290-1505

3. **Address** Silver Spring, MD 20910 (Code D21)

4. **Technology Name** Magnetomechanical Transducer

5. **Technology Type:** (a) Process (b) apparatus (c) material (d) service (e) study (f) other:

Descriptors: Magnetostriction Transducers

Applications: Transducers; Magnetic valves; Actuators; Vibration control

6. **Users** (a) Federal Government (b) State Government (c) Local Government (d) Small ind. (e) Medium ind. (f) Large ind. (g) Consultant (h) other:

7. **Potential Support:** exclusive license, (consulting,) joint venture, drawings, tooling, computer prog., economic study, training, adaptive eng., other:

8. **What Problem Does It Solve and How?** Improved magnetostrictive materials deliver high mechanical strains (approx. 1500 ppm) under heavy loads. This material can be energized rapidly by an external magnetic field. A magnetostrictive flow control device has been patented which provides a less complicated valve mechanism for precise and rapid microliter flow control. General application is for microvalves, actuators, and positioners.

9. **Other Uses:** Flow control for use in mass spectrometers; for supplying anesthesis gases; for blending fuels in process control systems.

10. **Main Advantages:** Extremely high strain, high force capability

11. **Production Information:** Currently manufactured at Ames Laboratory, Iowa State University, Ames, Iowa

12. **Descriptive Literature:** "Magnetostrictive RFe_2 Compounds" Vol I, Ferromagnetic Materials, ed., F.P. Wohlforth, North-Holland (1980)

13. **Literature Available From:** A.E. Clark, Code R45, Naval Surface Weapons Center White Oak, Silver Spring, MD 20910 Phone (301) 394-1313

Date: 9/30/83
Lab #: NSWC-TAA-83-002

TECHNOLOGY APPLICATION ASSESSMENT

14. Description

Magnetostrictive Flow Control Valve

Improved magnetostrictive materials are incorporated in a new electro-mechanical transducer patented (U.S. Patent #4,158,368) at NSWC for use as a fluid-flow control device.

Simple in design and operation, the flow control device is comprised of a cylindrical housing made from magnetostrictive materials with an electrical coil encircling its longitudinal axis. A tapered plunger, which exhibits negative magnetostriction, is placed within the housing along its longitudinal axis and seated with a discharge port. A magnetostrictive material is one that changes shape when placed in a magnetic field.

The improved magnetostrictive alloys used in this device are generally ternary mixtures of two heavy rare earths, which include praseodymium, terbium, samarium, holmium, erbium, and dysprosium, in combination with iron.

When an electrical current is passed through the coil, the magnetically sensitive materials in the housing expand relative to the plunger and cause the plunger to pull away from its seated position, thus opening the discharge port.

This flow control device design, which is available for licensing, provides a less complicated valve mechanism needed, for example, for precise and rapid microliter flow control, for use in mass spectrometers, for supplying anesthesis gases, or for blending fuels in process control systems.

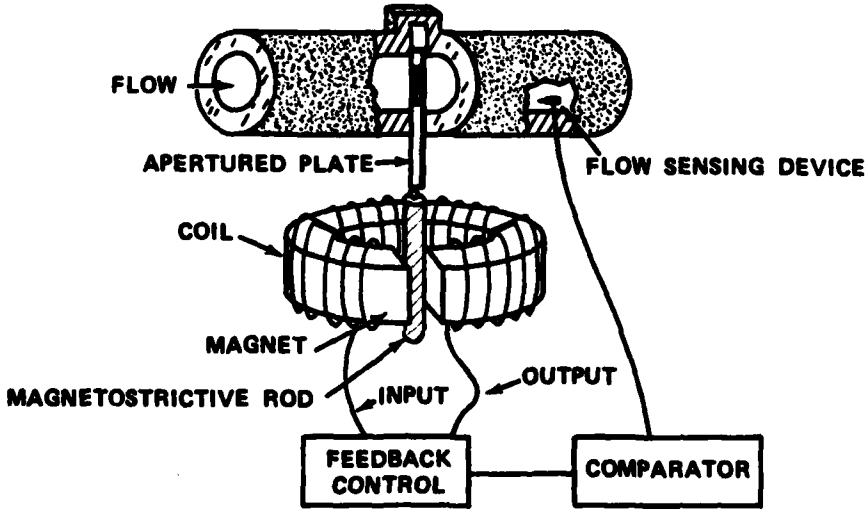


DIAGRAM OF MAGNETOSTRICTIVE FLOW CONTROL VALVE IN A FEEDBACK SYSTEM

TECHNOLOGY APPLICATION ASSESSMENT

Date: 9/30/83
CUFT #:
LAB #: NSWC-TAA-83-003

1. Laboratory Naval Surface Weapons Center

2. Contact (ORTA) Ramsey D. Johnson
Phone (301) 394-1505 Autovon 290-1505

3. Address Silver Spring, MD 20910 (Code D21)

4. Technology Name MHD Analogy Instrument

5. Technology Type: (a) Process (b) apparatus (c) material (d) service (e) study (f) other:

Descriptors: MHD; Magnetohydrodynamic Analogy; Shock; Supersonic; Underwater

Applications: Shock waves in water; supersonic flow field measurements in water

6. Users (a) Federal Government (b) State Government (c) Local Government (d) Small ind. (e) Medium ind. (f) Large ind. (g) Consultant (h) other: Educational institutions

7. Potential Support: exclusive license, (consulting,) joint venture, drawings, tooling, computer prog., economic study, training, adaptive eng., other:

8. What Problem Does It Solve and How? Simulation of supersonic flow in a liquid, such as water. An analogy instrument for the measurement of underwater shock waves and their interaction with submerged bodies. The instrument allows accurate simulation of supersonic flow in liquids without requiring large tank facilities.

9. Other Uses: Laboratory demonstration of underwater shock waves and their interaction with boundaries.

10. Main Advantages: Low cost; rapid results; easy to use

11. Production Information: Low risk/low cost technology, materials and fabrication techniques

12. Descriptive Literature: Navy Technical Disclosure Bulletin, Vol 8, No. 1, Sep 82

13. Literature Available From: NSWC ORTA: Ramsey D. Johnson (301) 394-1505

Date: 9/30/83
Lab #: NSWC-TAA-83-003

TECHNOLOGY APPLICATION ASSESSMENT

14. Description

Magnetohydrodynamic Analogy Instrument

NSWC has developed an instrument for studying supersonic flow in a compressible or liquid medium using the hydraulic analogy technique. The instrument is comprised of a tank holding a shallow layer of mercury through which a model under study traverses. An external magnetic field and current flowing through the mercury are adjusted to induce a force on the mercury simulating the property specific heat ratio or TAIT equation-of-state exponent.

The instrument allows extending the water table hydraulic analogy to specific heat values less than 2.0, and to TAIT equation exponent values greater than 2.0. The instrument, therefore, allows accurate simulation of supersonic flow in both compressible gas and liquids without building large wind tunnels and tanks.

A description is provided in the Navy Technical Disclosure Bulletin (Vol. 8, No. 1, Sep 1982) under Navy Case No. 66234.

TECHNOLOGY APPLICATION ASSESSMENT

Date: 9/30/83
CUFT #:
LAB #: NSWC-TAA-83-004

1. Laboratory Naval Surface Weapons Center

2. Contact (ORTA) Ramsey D. Johnson
Phone 394-1505 (301) Autovon 290-1505

3. Address Silver Spring, MD 20910 (Code D21)

4. Technology Name Hydraulic Analogy Test Instrument

5. Technology Type: (a) Process (b) apparatus (c) material (d) service (e) study (f) other:

Descriptors: Analogy; Testing; Shock; Supersonic; Gas

Applications: Shock waves in gas; supersonic flow field measurements in gas

6. Users (a) Federal Government (b) State Government (c) Local Government (d) Small ind. (e) Medium ind. (f) Large ind. (g) Consultant (h) other: Educational institutions

7. Potential Support: exclusive license, consulting, joint venture, drawings, tooling, computer prog., economic study, training, adaptive eng., other:

8. What Problem Does It Solve and How? Simulation of supersonic flow in a gas, such as air. An analogy instrument for the measurement of shock waves in gases and their interaction with immersed bodies. The instrument permits accurate simulation of supersonic flows without the need of large wind tunnels.

9. Other Uses: Laboratory demonstration of shock waves in gases and their interactions with boundaries.

10. Main Advantages: Low cost; rapid results; easy to use

11. Production Information: Low risk/low cost technology materials and fabrication techniques

12. Descriptive Literature: Patent Application No. 6378161 (5/14/82)

13. Literature Available From: NTIS, No. AD-D009574/5

Date: 9/30/83
Lab #: NSWC-TAA-83-004

TECHNOLOGY APPLICATION ASSESSMENT

14. Description

Hydraulic Analogy Instrument for Gasdynamic Flows

NSWC has developed an instrument for studying supersonic flow in gases using the hydraulic analogy technique. The instrument is comprised of a tank holding a shallow layer of heavy liquid, such as mercury, covered by a layer of light liquid, such as water. A test model is moved along the bottom of the tank through the lower liquid, producing a wave pattern at the interface between the two immiscible liquids. The wave propagation speed of waves on the interface between the two liquids can be selected by choice of thicknesses and mass densities of the two liquids. Therefore, it is possible to simulate the speed of sound of most gases of practical interest.

The instrument allows extending the water table analogy to specific heat ratios in the range 1.0 to 2.0, and permits accurate simulation of supersonic flows without the need of large wind tunnels. Also, the technique can be used to simulate blast waves from explosions, and their interaction with targets.

A patent application (Serial No. 6378161) was filed on 14 May 1982.

TECHNOLOGY APPLICATION ASSESSMENT

Date: 9/30/83
CUFT #:
LAB #: NSWC-TAA-83-005

1. **Laboratory** Naval Surface Weapons Center

2. **Contact (ORTA)** Ramsey D. Johnson
Phone 394-1505 (301) **Autovon** 290-1505

3. **Address** Silver Spring, MD 20910 (Code D21)

4. **Technology Name** Radiographic Nondestructive Evaluation

5. **Technology Type:** (a) Process (b) apparatus (c) material (d) service (e) study (f) other:

6. **Users** (a) Federal Government (b) State Government (c) Local Government (d) Small ind. (e) Medium ind. (f) Large ind. (g) Consultant (h) other: American Society for Testing Materials (ASTM)

Descriptors: Radiographic Nondestructive Evaluation; or Radiographic Testing; or Radiographic Inspection

Applications: R&D Evaluation of: thin plastics and aluminum, steel structures up to 12" thick, graphite-aluminum composites, batteries (all types), explosives (up to 10 lbs), electronic components, and missile components

7. **Potential Support:** exclusive license, consulting, joint venture, drawings, tooling, computer prog., economic study, training, adaptive eng., other: R&D

8. **What Problem Does It Solve and How?** This is a nondestructive test method for evaluating flaws and discontinuities in all types of materials. Radiography solves the problem of inspecting materials without destroying product usefulness. This inspection method is accomplished by X-rays penetrating an object, and thus producing a permanent visible photographic record of the internal appearance and condition of the object.

9. **Other Uses:** Detects missing and unsafe components. Detects the condition of materials before and after vibration testing, heat and humidity testing, drop tests, etc.

10. **Main Advantages:** Radiographic testing does not destroy product usefulness, and a visible permanent film record of the internal condition of an object is produced.

11. **Production Information:** X-ray film is expensive, special skills and technology are required.

12. **Descriptive Literature:** Books on the fundamentals and uses of industrial radiography

13. **Literature Available From:** Technical libraries

Date: 9/30/83
Lab #: NSWC-TAA-83-005

TECHNOLOGY APPLICATION ASSESSMENT

14. Description

NSWC's Radiographic Facility

NSWC's fully equipped radiographic facility at White Oak, Silver Spring, MD, provides full-spectrum capability for the radiography of materials and structures. Capabilities extend over a broad range from 10 keV microfocus to 10 MeV.

With highly specialized personnel and equipment, the facility has the capacity to evaluate very thin plastics and aluminum; and, on the other end of the scale, it is capable of generating X-rays that can penetrate up to 12 inches of steel. Interpretive results range from minute discontinuities in very thin materials to flaws in the steel welds of submarines.

In this facility, numerous radiographic standards have been developed and are maintained for welds associated with various metals. Its R&D efforts in penetrometers or image quality indicator studies are known worldwide. At the Center, personnel conducted experiments aimed at developing a method for evaluating and classifying X-ray films and pursued a technique for curing explosive binders with high-energy X-rays.

R&D work conducted here not associated with radiographs includes a fuze inspection system that uses realtime X-ray gauging technology to reject defective fuzes in a production environment.

Applications

- o Quality Assurance Standards for Navy equipment
- o Radiographic standards for both thin and thick welds
- o Activation point studies of Lithium batteries
- o On-line radiographic control of automated fuze systems
- o Metal Matrix Composite NDE technology

APPENDIX C

NSWC INVENTIONS AND PATENTS IN FY83

TECHNOLOGICAL AREA	NAVY CASE OR PATENT NO.	TITLE AND PURPOSE	POTENTIAL COMMERCIAL APPLICATIONS
1. Missile guidance system	65,821	A New Guidance Law to Improve the Accuracy of Tactical Missiles	Any canard controlled airframe would use the system
2. Metallurgy	65,305	Mixing of SiC Whiskers with Aluminum and Magnesium in a Eutectic Formation	Has great potential in high temperature aluminum-magnesium eutectic formation
3. Combustion chamber	63,318	Bi-planner Swirl Combustor	Combustion chamber for steam generator that makes 30-40% fuel savings
4. Semiconductors	59,648	Process for Preparing Isolated Plamar Junctions in Thin-Film Semiconductors (Improved Method)	Semiconductor manufacture
5. Aeronautics	59,536	Adapter Assembly for Flat Trajectory Flights (for Unguided Projectiles)	Aeronautics
6. Fiber optics	63,442	Cable Connector (for Joining Optical Cables)	Communications
7. Spacecraft	60,606	Deployable Support Structure for Spacecraft (for Stowing During Launch)	Space launch vehicles
8. Aeronautics	57,697	Flat Trajectory Projectile	Aeronautics
9. Refrigerant containment	65,764	Method of Charging and Hermetically Sealing High Pressure Gas Container	Commercial satellites; Guidance
10. Radiation absorption	66,216	Neutron Radiation Shielding Material and Method of Preparation	Power plants; Nuclear processing
11. Radiation shielding	66,982	Radiation Source Shield and Calibrator	Power plants; Nuclear processing

TECHNOLOGICAL AREA	NAVY CASE OR PATENT NO.	TITLE AND PURPOSE	POTENTIAL COMMERCIAL APPLICATIONS
12. Ball bearings	4,364,170	Ball Bearings Assembly Device (Mechanism for Aiding Assembly of Ball Bearing Between Races)	Ball bearing manufacture
13. Magnetostrictive materials	65,888	Magnetomechanical Energy Conversion	Hydrophones; Pressure sensors
14. Magnetostrictive materials	4,378,258	Conversion Between Magnetic Energy and Mechanical Energy	Transducers; sonar; sound transmission elements; sonic delay lines; sonic filters
15. Explosives	4,372,213	Molten Metal-Liquid Explosive Method	Explosives
16. Materials testing	4,352,292	Instrument for Measuring Dynamic Viscoelastic Properties	Rubber shock absorbers
17. Conveyors	66,373	Load-Unload Sensor (Mechanism for Protecting Conveyor Overload)	Conveyors
18. Electrical power overcurrent	4,363,064	Overcurrent Protection System	Adaptable for use with power controllers of the single- or multiphase AC, or DC types
19. Electrical (semiconductor devices)	4,371,232	Graded Gap Semiconductor Device	A method of preparing epitaxial films for use as infrared detectors, lenses, and light emission devices
20. Electrical (semiconductor devices)	4,391,651	Method of Forming a Hyperabrupt Interface in a GaAs Substrate	Technique for creating a hyperabrupt interface between the electrical active and the underlying layer of a semiconductor substrate
21. Electrical (semiconductor devices)	4,380,774	High-Performance Microwave Transitor	Improved high frequency response coupled with increased power output in the microwave range

TECHNOLOGICAL AREA	NAVY CASE OR PATENT NO.	TITLE AND PURPOSE	POTENTIAL COMMERCIAL APPLICATIONS
22. Electrical (active and passive filters)	66,306	Semi-Active Notch Filter	Useful as a component in phase-locked-loops
23. Electrical (phase shifter)	66,061	An Electronic Phase Shifter Having a Constant Magnitude Output	Useful as components in phase-locked-loops
24. Electrical (magnetometers)	4,384,254	Oscillator/Driver Circuit for Fluxgate Magnetometer	Useful as a component in a vehicle detector and in an intrusion detector, for example

DISTRIBUTION

	Copies
Chief of Naval Material Attn: MAT-08I Washington, DC 20360	2
Defense Technical Information Center Cameron Station Alexandria, VA 22314	12
Library of Congress Attn: Gift and Exchange Division Washington, DC 20540	4
U.S. Coast Guard Headquarters Code EOE-2 Washington, DC 20590	1
Center for the Utilization of Federal Technology Attn: Mr. Edward J. Lehmann NTIS, Room 8R Springfield, VA 22161	1
Internal Distribution:	
C	1
D	1
D1	1
D2	1
D21	35
E	1
F	1
G	1
K	1
N	1
R	1
U	1
TJ	1
E2A	1
E21 (Boyer)	1
E24 (Spring)	1
E35	1
E411	1
E421	1
E431	9
E432	3
F34 (Kenyon)	1
G35 (Holt, Poppen)	2
G402 (Matra)	1
G52 (Ramey)	1
G53 (Rowe)	1
G61 (Coghill)	1
K13 (Sims)	1
K26	1
K50	1
R15 (Barber, Dempsey)	2
R16 (Kayser)	1
R41 (Simms)	1
U13 (Ludtke)	1
U23 (Baldwin, Steves)	2
U42 (Phelps)	1
U48 (Sadek)	1


84